

☐ Action
☐ Information
☒ Discussion

DATE: November 5, 2020
TO: Environmental Services Commission
FROM: Doug Lane, Senior Engineer
SUBJECT: Water System Post-Earthquake Level of Service Goals

Action Required at this Time

None

Fiscal Impact

Under evaluation

Policy Issues

Post-Earthquake Level of Service Goals

Background

Bellevue's water distribution system and the regional water supplies were designed and constructed prior to a full understanding of local earthquake potential. As a result, this infrastructure is vulnerable to significant service disruption caused by severe earthquake events in the Cascadia Subduction Zone and the Seattle Fault. Staff will present predicted water system impacts, recovery times and resulting economic damage to the community following severe earthquake events with existing infrastructure. Staff will then discuss the proposed post-earthquake level of service (PE-LOS) goals assumed for planning mitigation projects.

As part of the City's water distribution system seismic vulnerability assessment, impacts and post-earthquake performance in Bellevue have been simulated based on known geological hazards, current system information, and observed water system response from past worldwide earthquake events. Table 1 shows anticipated impacts to the existing water system following either of these two severe local earthquake scenarios.

Table 1: Simulated Earthquake Impacts with Existing Infrastructure

Event	Return Period	Pipe Repairs	Service Restored (%) after:					Economic Damage
			3 days	30 days	45 days	70 days	90 days	
Cascadia Subduction Zone	500 yr	220	35%	40%	70%	100%	100%	\$2.3 Billion
Seattle Fault Zone East	800 yr*	540	0%	5%	22%	60%	100%	\$8.3 Billion

* Estimated 50% likelihood of full Seattle Fault eastern rupture during 800-year event

There are several strategy alternatives to improve seismic performance, including:

- 1. Do Nothing: Accept existing performance and risks.
- 2. Minimal: Replace assets based on existing R&R schedule. (100+ years)
- 3. Risk-Based: Prioritize improvements based on risk reduction benefit/cost. (20-50 years)
- 4. Aggressive: Replace vulnerable assets as quickly as feasible (< 20 years)

Alternative 1 (Do nothing) conflicts with both City policy and the U.S. America’s Water Infrastructure Act, and is not recommended. Alternative 2 (baseline R&R with more resilient pipe) is viable, but accepts an annual economic risk estimated to be +/- \$5 Million per year with existing infrastructure, and lags behind similar utilities’ approach to seismic resiliency. Alternative 3 seeks the most efficient, beneficial and critical resiliency improvements over a reasonable timeframe, consistent with other local and regional utilities, and is recommended. Alternative 4 is likely not feasible or affordable, is disproportionate with industry practices, and may not be defensible based on the estimated risk and event return periods.

Resiliency objectives are typically expressed as post-earthquake level of service (PE-LOS) goals. Figure 1 shows an example of how PE-LOS goals are typically portrayed. Bellevue’s proposed short-term (10-year), medium-term (20-year) and long-term (50-year) PE-LOS goals are shown using this methodology for the Cascadia Subduction Zone (CSZ) and Seattle Fault Zone East (SFZE) events in Attachment 1 and Attachment 2, respectively. An engineering consultant (Jacobs) is now modeling Bellevue’s predicted earthquake performance with numerous potential improvement projects to attain these PE-LOS goals.

Figure 1: Example Post-Earthquake Level of Service Chart



Following analysis, the improvement projects and costs required to achieve the attached PE-LOS goals will be presented at a future ESC meeting for discussion. PE-LOS goals will then be revisited, and included as a new policy in the forthcoming Emergency Water Supply Master Plan.

Attachments

- 1 - Proposed Cascadia Subduction Zone (CSZ) Post-Earthquake Level of Service Goals
- 2 - Proposed Seattle Fault Zone East (SFZE) Post-Earthquake Level of Service Goals